REPORT

BY

SANDFORD FLEMING, C.M.G., C.E.

ON

Condition of Ottawa River

FROM OTTAWA TO GRENVILLE

IN SUMMER OF 1888

AS AFFECTED BY

Sawdust and other Mill Refuse

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OTTAWA, January 30th 1889.

To the Committee of Lumber Manufacturers, Ottawa:

GENTLEMEN,—Having been requested by you to make an examination of that part of the River Ottawa, between the City of Ottawa and Grenville, I have now the honor to report the result.

The object of the examination was to ascertain to what extent the refuse from the various sawmills interferes with public and private rights and more especially to determine definitely how far the navigation of the river is obstructed from the same cause.

The examination has been made in general by myself and in detail by my son S. H. Fleming under my instructions.

The refuse from the mills consists of sawdust, edgings, buttings and slabs. A large proportion of the slabs and heavy refuse is not cast into the river, it is separated at each of the mills and generally sold for fuel and other uses.

At most, if not at all the mills, the slabs and heavy refuse not sold, are broken into small fragments by a machine sometimes designated a "hogging machine".

There can be no doubt that all or nearly all the light refuse, such as sawdust and broken-up slabs together with some of the edgings and buttings finds its way into the river; the exact proportions of edgings and buttings are not easily ascertained.

The annual product of manufactured lumber of all sorts at the various mills around the City of Ottawa will probably average fully 300,000,000 feet B. M. If we estimate 10 per cent. of the annual output as waste we have 30,000.000 feet B.M. or 92,592 cubic yards of refuse, a large proportion of which passes into the river. Whatever the proportion, it is reasonable to suppose that such a quantity of foreign matter if deposited locally would necessarily produce some marked effect. Much, if not the whole of this waste material is buoyant and it is carried away by the stream to a greater or lesser distance, possibly some portion finds its way to the lower reaches of the river, towards the ocean.

In its passage down the river the sawdust floats for a time. While it remains on the surface it is moved by the wind and not infrequently is blown into bays and sheltered spots where, if not removed by a change of wind, it in course of time becomes saturated and disappears.

In such places where the water is still, the water-logged particles of sawdust find their way to the bottom. Owners of property especially in the neighborhood of Ottawa, in some cases claim to suffer damage from the deposit of mill waste in front of their lands, and likewise from its presence on the surface of the water. In an artistic point of view,

the broad expanse of sawdust often seen during the summer months floating on the river, is undoubtedly detrimental to the landscape. Likewise it is objected to by those who indulge in pleasure boating.

The waste product from the mills is however not without advantage to another class of people. There are a large number of families settled along the river banks between Ottawa and Grenville who appear to have selected this site of their habitations on account of the supply of fuel which is annually floated to their doors. During the summer months numbers of women and children may be seen regularly at work in boats and canoes gathering in from the stream their winter's supply of fuel.

There is in reality a considerable population dependent on the mills for their winter's firewood which thus costs them only the trouble of gathering it.

As already indicated, I found large deposits of sawdust in side channels, sheltered bays, eddies and inlets, but the main channel of the river remains unobstructed for the purposes of navigation.

I caused soundings to be taken during the past season on lines of cross-sections which were made by the Government Engineers the year previous.

These cross-sections extend generally from shore to shore of the Ottawa, across the navigable channel, at the following points, viz :—

1.	Line A-A at Upper end of Kettle Island,	3	miles below Ottawa.
2.	" B-B " Lower " Kettle Island,	5	"
3.	" C-C " " " Goose Island,	7¾	"
4.	" D-D " Upper " Lenard Island,	10	"
5.	" E-E " Lievre River,	16	"
6.	" F-F " Rockland,	21	"
7.	" G-G " Upper end of Clarence Isld.	26¼	"
8.	" H-H" Nation River,	34	"
9.	" I-I " Montebello,	44	"
10.	" K-K" McTavish Light House	50½	"
11.	" L-L " Calumet,	57¼	"

Attention is directed to both sets of soundings which for ease of comparison are reduced to the same datum and shown side by side on the accompanying sheets (numbered I to II.)

An examination clearly shows that the bed of the river has to some extent been changed within the period of twelve months, and that the change is generally in the increase of depth. At one or two points, the bed rock of the river has been laid bare, so that the depth at such spots cannot be further increased from the same natural cause. I can only account for the increase of depth in the channel by a greater scouring effect of the current, and it is just possible that this may be due to the lessening of the depth in the bays and shallows and side inlets, producing a tendency to increase the flow of water in the central portion of the

river. Be the reason what it may, it appears that the navigable channel is fully maintained in its integrity, and the increase in depth is confirmed by the statements of old river pilots who allege that the channel is better now than it was thirty or forty years back.

In addition to the new cross-sections referred to, a series of soundings has been made on a continuous line along the entire length of the channel from Ottawa to Grenville, a distance of sixty miles. These soundings reveal a depth of water for the greater part of the distance which is indeed remarkable.

The accompanying longitudinal section shows the soundings taken in this sixty-mile stretch. These and all the other soundings although taken at different stages of the water, have been reduced to a common uniform datum. This datum conforms with the lowest level of the river of which we have any record, and is established by the observations of the Ottawa Lockmaster of the Rideau Canal, taken daily during a period of seventeen years. A copy of this officer's record is appended; he gives the level of the water above the sill of the lower lock showing the daily variations of the river.

I find the extreme range of level of the River Ottawa in each year, according to this record, as follows:

Year.	Date.	Highest. ft.	in.	Date.	Lowest. ft.	in.	Yly. Range ft.	in.
1872	May 18	21	5	April 1	5	7	15	10
1873	May 24	24	5	Sept. 17	6	10	17	7
1874	June 1	22	5	Sept. 20	5	9	16	8
1875	May 20	23	8	Feby. 27	6	5	17	3
1876	May 16	29	6	Sept. 29	5	7	23	11
1877	May 1	15	0	Sept. 26	5	8	9	4
1888	Oct. 21	15	2	Sept. 14	6	4	8	10
1879	May 22	14	10	Nov. 12	5	11	8	11
1880	May 18	23	11	Oct. 1	6	10	17	1
1881	May 20	20	3	Oct. 1	4	6½	15	8½
1882	June 1	20	6	Feby. 11	7	2	13	4
1883	July 5	18	10	April 7	7	1	11	9
1884	May 13	20	10	Sept. 21	6	11	13	11
1885	May 23	21	6	Oct. 15	7	5	14	1
1886	May 1	24	2	Sept. 19	7	8	16	6
1887	May 10	24	3	Oct. 24	4	8	19	7
1888	May 21	24	2	Mch. 20	6	2	18	0

HIGHEST WATER.

Highest in 17 years, May 16, 1876	29 ft.	6 in.
Minimum highest in 17 years, May 1, 1877	15 "	0 "
Mean highest in 17 years	21 "	5 "

LOWEST WATER.

Lowest in 17 years, Oct. 1, 1881	4	ft. 6½	in.
Maximum lowest in 17 years, Sept. 19, 1886	7	" 8	"
Mean lowest in 17 years	6	" 3	"

RANGE OF WATER LEVEL.

Greatest range of level in 17 years	24	ft. 11½	in.
Greatest yearly range of level, (1876)	23	" 11	"
Least yearly range of level, 1878	8	" 10	"
Mean yearly range of level in 17 years	15	" 9	"

Taking each separate mile of the river from Ottawa to Grenville, the minimum and maximum depths under extreme low water in the channel, as depicted on the longitudinal section, are as follows :

NOTE.—In the 1st mile the longitudinal section shows the depths in the main channel of the river from the Chaudiere downwards—not in the bay leading to the Rideau Canal.

	Least Depth. feet.	Greatest Depth feet.
1st mile below Ottawa	35	55
2nd " "	31	79
3rd " "	10	75
4th " "	8	30
5th " "	18	28
6th " "	10	17
7th " "	14	16
8th " "	10	20
9th " "	6	32
10th " "	7	33
11th " "	8	21
12th " "	20	30
13th " "	27	33
14th " "	11	33
15th " "	18	33
16th " "	26	34
17th " "	24	35
18th " "	22	33
19th " "	19	26
20th " "	18	34
21st " "	34	62
22nd " "	35	65
23rd " "	31	39

			Least Depth. feet.	Greatest Depth feet.
24th	mile below	Ottawa	25	31
25th	"	"	18	24
26th	"	"	18	21
27th	"	"	21	45
28th	"	"	28	46
29th	"	"	17	28
30th	"	"	13	19
31st	"	"	7	16
32nd	"	"	12	72
33rd	"	"	37	74
34th	"	"	26	37
35th	"	"	30	50
36th	"	"	41	142
37th	"	"	90	134
38th	"	"	82	100
39th	"	"	46	82
40th	"	"	48	78
41st	"	"	31	58
42nd	"	"	31	55
43rd	"	"	44	140
44th	"	"	75	113
45th	"	"	103	137
46th	"	"	113	135
47th	"	"	103	113
48th	"	"	65	103
49th	"	"	50	66
50th	"	"	42	52
51st	"	"	52	98
52nd	"	"	50	98
53rd	"	"	40	50
54th	"	"	44	118
55th	"	"	14	118
56th	"	"	21	39
57th	"	"	39	63
58th	"	"	32	50
59th	"	"	14	32
60th	"	"	10	26

These soundings establish that when the water is at its lowest the channel between Ottawa and Grenville is for a total length of 59 miles greater in depth than 10 feet; that for one-third of the whole distance the depth exceeds 50 feet; that for about 11 miles it exceeds 75 feet, and that for 5½ miles the water is more than 100 feet, attaining a depth of 142 feet under the lowest recorded level.

Only at five points on the whole distance of 60 miles is the depth of the channel at extreme low water under 10 feet. They are as follows:

1st.—At the entrance to the Rideau Canal for about 600 feet out from the lower lock.

2nd.—At the head of Kettle Island at the beginning of the 4th mile from Ottawa, near the cross-section marked "A-A." Here the least depth in the channel is 8½ feet.

3rd.—On the 9th mile below Ottawa, near the light house, directly east of the cross-section marked "C-C." Here the least depth in the channel is 6 feet.

4th.—Below the mouth of the Blanche River on the 10th mile from Ottawa. Here the least depth in the channel is 7 feet,

5th.—At Parker's Island on the 31st mile below Ottawa. Here the least depth in the channel is 7 feet.

These places have been examined carefully; the shallow spots are of no great extent, being limited to a few hundred yards in each case, and as already stated there is only an aggregate distance of a mile in the whole 60 miles within which the depth is not greater than 10 feet. Borings have been made by which it is established that in cases 2 and 3 the material in the channel bed is coarse red sand. In cases 4 and 5 the borings indicate a fine sand or silt; the material in all cases being easy of removal. Except in the case of No. 1 the borings did not reveal the presence of sawdust or mill refuse in any form in any part of the main channel. It is inferred that these points are simply natural shallows such as are found in all rivers.

The evidence goes to show that these shallow portions of the channel have quite as much water over them as when the River Ottawa was first navigated. Only in the case of No. 1 is the navigation in question affected. Here there is a deposit for a distance of about 200 yards outwards, from the entrance to the lower lock. The deposit here is probably for the most part sawdust, and it is due to the fact that the entrance to the Rideau Canal is in a deep and sheltered bay, where the sawdust collects and where there is no current sufficient to carry it away. With this exception, it is established beyond all question that no appreciable injury has been done to the navigable channel of the river through the operations of the lumbering manufacturers.

Moreover, it appears that the lumber manufacturing interests would suffer very much more than all other interests from any possible injury to the navigation. This inference is drawn from the volume of river traffic, as shown by government returns. If the tolls collected on ton-

nage passing the Grenville Canal be taken as a criterion, we may judge of the value of the traffic by the following table, which gives a comparison for a period of ten years.

Year.	Total Tolls collected.	Tolls on Sawn Lumber	Tolls on all other Freights.
1878	34,527	$28,688	$5,839
1879	35,392	29,727	5,665
1880	39,309	33,631	5,678
1881	52,245	46,496	5,749
1882	51,153	43,890	7,263
1883	55,665	48,250	7,415
1884	53,845	46,946	6,899
1885	49,337	44,036	5,301
1886	50,620	45,664	4,956
1887	49,830	45,516	4,314
Totals....	$471,923	$412,844	$59,079

By these returns it is established that the gross revenue from Canal tolls in 10 years ending 31st December, 1887, was $471,923 of which sawn lumber contributed $412,844, and all other traffic $59,079.

If we take by way of example the last year given in the table, viz., 1887, we have as follows :—

	Tons.	Tolls.
Total freight of all sorts.....	684,047	$49,830 01
Sawn lumber.....	558,490	45,516 14
All other traffic.....	124,557	4,313 87

The sawn lumber above named does not include the following :

	Tons paying tolls.	Tolls amounting to.
Timber in rafts.....	2,189	$76 60
Saw logs.....	14,074	327 80
Railway ties.....	3,625	391 22
Shingles.....	563	441 71
Floats.....	27,126	399 80
Firewood.....	43,152	1,379 32
Tons.....	90,729	Tolls..3,016 45

If the latter tolls be included it would appear that the lumbering interests contributed $48,522.59 of a total canal revenue of $49,830.11. But taking sawn lumber alone which pays close on 90 per cent. of the

aggregate tolls collected, there cannot be a doubt that the manufacturers, are to a much larger extent concerned in the navigation of the river than all other interests combined.

In connection with the depth of water in the channel my enquiries go to show that the barges used in the transportation of sawn lumber are greater in draught than any other craft now employed or which have at any previous time been employed on the river.

The question arises, are the causes in operation, if continued for a sufficiently long period, likely to damage the Ottawa as a navigable stream? This enquiry is of great importance and demands special attention.

It is not easy to ascertain the exact quantity of solid matter cast into the river from the mills, be the quantity what it may, the material being buoyant is carried forward a greater or lesser distance before it sinks or disappears.

Wherever it may find its way to the bottom, it is seldom found in a compact body. A deposit of sawdust is easily moved by currents, and as the volume of water in the Ottawa during floods is very large and of great force it may be assumed that no deposit of this loose material can remain in the shallow parts of the main channel, where in fact the currents are always greatest.

It has been satisfactorily established by the recent examination that during the constantly recurring periods of high water any such deposits are moved forward by the scour of the currents and carried probably to parts of the river where the water is deep and still.

Taking that portion of the Ottawa between this City and Grenville and dividing the whole distance of 60 miles into subdivisions of 10 miles each, we obtain from the recent measurements the following average depths in the channel at extreme low water.

	Least depth.	Greatest depth.
1st sub-division average.....	14 ft. 9 in.	38 ft. 5 in.
2nd sub-division average.....	19 " 3 "	31 " 2 "
3rd sub-division average.....	24 " 0 "	37 " 6 "
4th sub-division average.....	41 " 9 "	78 " 6 "
5th sub-division average.....	65 " 7 "	97 " 2 "
6th sub-division average.....	31 " 6 "	69 " 2 "

From these averages we have for the whole 60 miles of the channel taken in sub-divisions of 10 miles.

1. A mean minimum depth of 32 ft. 9 in.
2. A mean maximum depth of 58 ft. 7 in.
3. A general mean depth of 45 ft. 9 in.

It will be borne in mind that all these depths mentioned refer to a stage of the water which has only occurred once in the past 17 years, that is to say when the river fell to but 4 ft. 6½ in. over the lock sill of the Rideau Canal, on the 1st of October, 1881.

The large quantity of refuse passing from the mills would in a shallow sluggish river very soon produce objectionable consequences, but the deductions drawn from the recent survey show conclusively that the Ottawa is so exceptional in its character and has depths so profound that the evils to be feared from the filling up of the channel are exceedingly remote.

I have had an estimate prepared to convey some idea of the length of time which would elapse before the deep parts of the river between Ottawa and Grenville would be filled. This estimate is based on the soundings recently made and on other data. According to this estimate it would require 350,000,000 cubic yards of solid material to fill up the deeper parts to a line ten feet under extreme low water. I have already indicated that the quantity of sawdust and refuse of all kinds passing from the mills cannot on an average be more than 100,000 cubic yards per annum. It is not possible to determine what part of this material remains above Grenville. It is reasonable to suppose that some of it finds its way to the lower reaches of the river, but assuming that no part of it is carried towards the ocean and that its volume is not reduced by pressure or by any natural process, the question resolves itself into one of simple proportion, viz:—How long will it take to deposit 350,000,000 cubic yards at the rate of 100,000 cubic yards per annum? This whole calculation may be held to be but roughly approximate, yet it will give some idea of the enormous length of time which would elapse before the deep space under the level demanded by a navigable channel could be filled up.

The examination which I have made points to the following conclusion:

1. With respect to private interests, there can be no doubt that riparian owners in some individual cases suffer actual damage from the operations of the lumber manufacturers. While this is the case more especially in the neighborhood of Ottawa there are many persons living along the river banks between this City and Grenville who are benefited in a manner which to them may be considered material. These persons may indeed be counted by hundreds, and they would feel it to be a great deprivation if through any cause they were cut off from their annual supply of firewood.

2. There has been a deposit of sawdust directly in front of the Rideau Canal in the City of Ottawa, it extends from the lower lock, a short distance into the river. The removal of less than 10,000 cubic yards by dredging at this spot would enable all vessels navigating the canal to enter with ease when the water is at its lowest stage. With this

single exception I am unable to see that the navigation of the river Ottawa has been injuriously interfered with to any appreciable extent. Moreover, if the official returns afford a means of judging, it appears that the lumbering interest are more deeply concerned in the maintenance of the navigation than all other interests. The official returns of traffic through the Grenville canal showing that the lumber business pays nearly all the tolls collected.

3, With regard to the future it is conclusively established that there is no probability of the navigation between the City of Ottawa and Grenville being irretrievably destroyed or seriously obstructed from the cause assigned for centuries to come.

I have the honor to be, Gentlemen,

Your obedient servant,

(Signed) SANDFORD FLEMING.